

Title (en)

Differentiated progeny of clonal progenitor cell lines

Title (de)

Differenzierte Nachkommenschaft von klonalen Vorläuferzelllinien

Title (fr)

Descendance différenciée des lignées de cellules progénitrices clonales

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Application

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Abstract (en)

Aspects of the present invention include methods and compositions related to the production and use of embryonic progenitor cell types useful in the generation of cartilage, bone, choroid plexus, tendon, lipasin-secreting adipocytes, and other differentiated cell types useful in research and therapy.

IPC 8 full level

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- US 2006030632 W 20060803
- US 37451203 A 20030227
- US 0029551 W 20001027
- US 2006040985 W 20061020
- US 60404706 A 20061121
- US 30402002 A 20021126
- US 7582479 B2 20090901 - THOMSON JAMES A [US]
- US 7217569 B2 20070515 - THOMSON JAMES A [US], et al
- US 6887706 B2 20050503 - ZHANG SU-CHUN [US], et al
- US 6602711 B1 20030805 - THOMSON JAMES A [US], et al
- US 6280718 B1 20010828 - KAUFMAN DAN S [US], et al
- US 5843780 A 19981201 - THOMSON JAMES A [US]
- US 0018063 W 20000630
- US 2002142397 A1 20021003 - COLLAS PHILIPPE [NO], et al
- US 2005014258 A1 20050120 - COLLAS PHILIPPE [NO], et al
- US 2003046722 A1 20030306 - COLLAS PHILIPPE [NO], et al
- US 2006212952 A1 20060921 - COLLAS PHILIPPE [NO], et al
- US 2012171171 A1 20120705 - WEST MICHAEL D [US], et al
- US 2010184033 A1 20100722 - WEST MICHAEL D [US], et al
- US 2008070303 A1 20080320 - WEST MICHAEL D [US], et al
- US 7928069 B2 20110419 - PRESTWICH GLENN D [US], et al
- US 7981871 B2 20110719 - PRESTWICH GLENN D [US], et al
- WO 2005068610 A1 20050728 - ADVANCED CELL TECH INC [US], et al
- WO 9920741 A1 19990429 - GERON CORP [US], et al
- US 5922601 A 19990713 - BAETSCHER MANFRED [US], et al
- US 6248934 B1 20010619 - TESSIER-LAVIGNE MARC [US], et al
- US 2004219563 A1 20041104 - WEST MICHAEL [US], et al
- US 2006020552 W 20060526
- US 50463009 A 20090716
- US 201213456400 A 20120426
- WO 2011009106 A2 20110120 - BIOTIME INC [US], et al
- THOMSON ET AL., SCIENCE, vol. 282, 1998, pages 1145 - 1147
- CIBELLI ET AL., NATURE BIOTECH, vol. 16, 1998, pages 642 - 646
- LANZA ET AL., NATURE MEDICINE, vol. 5, 1999, pages 975 - 977
- CHUNG ET AL., CELL STEM CELL, vol. 2, 2008, pages 113
- WEST ET AL., REGENERATIVE MEDICINE, vol. 3, no. 3, 2008, pages 287 - 308
- STOJKOVIC ET AL., STEM CELLS, vol. 23, no. 3, 2005, pages 306 - 14
- ROSLER ET AL., DEV DYN., vol. 229, no. 2, 2004, pages 259 - 74
- DURICK ET AL., GENOME RES., vol. 9, 1999, pages 1019 - 25
- SCHWARZE; DOWDY, TRENDS PHARMACOL. SCI., vol. 21, 2000, pages 45 - 48
- KROSL ET AL., NATURE MEDICINE, 2003, pages 1428 - 1432
- HO ET AL., CANCER RESEARCH, vol. 61, 2001, pages 473 - 477
- VIVES ET AL., J. BIOL. CHEM., vol. 272, 1997, pages 16010 - 16017
- WEST ET AL., REGEN MED, vol. 3, no. 3, 2008, pages 287 - 308
- BECKER, R. A.; CHAMBERS, J. M.; WILKS, A. R.: "The New S Language", 1988, WADSWORTH & BROOKS/COLE
- EVERITT, B.: "Cluster Analysis", 1974, HEINEMANN EDUC. BOOKS
- KURIMOTO ET AL., NUCLEIC ACIDS RESEARCH, vol. 34, no. 5, 2006, pages E42
- LUO, Y.; CAI, J.; GINIS, L.; SUN, Y.; LEE, S.; YU, S.X.; HOKE, A.; RAO, M.: "Designing, testing, and validating a focused stem cell microarray for characterization of neural stem cells and progenitor cells", STEM CELLS, vol. 21, 2003, pages 575 - 587

- HEDMAN ET AL.: "Isolation of the pericellular matrix of human fibroblast cultures", J. CELL BIO., vol. 81, 1979, pages 83 - 91
- STERNBERG ET AL.: "A human embryonic stem cell-derived clonal progenitor cell line with chondrogenic potential and makers of craniofacial mesenchyme", REGEN MED., 23 April 2012 (2012-04-23)
- ZHANG, R.: "Wnt/(3-catenin signaling activates bone morphogenetic protein 2 expression in osteoblasts", BONE, vol. 52, 2012, pages 145 - 156
- BINELLO, E.: "Stem cells as therapeutic vehicles for the treatment of high-grade gliomas", NEURO ONCOL., vol. 14, no. 3, 13 December 2011 (2011-12-13), pages 256 - 65
- DAVSON, H.: "Physiology of the Cerebrospinal Fluid", 1967, J. & A. CHURCHILL, LTD.
- "Biology Data Book, 2nd ed.", vol. III, 1974, FED. AM. SOC. EXPER. BIOL.
- SUBRAMANIAN, PNAS, vol. 102, no. 43, 25 October 2005 (2005-10-25), pages 15545 - 15550
- J BIOL CHEM., vol. 271, no. 17, 26 April 1996 (1996-04-26), pages 10194 - 9
- STERNBERG ET AL.: "A human embryonic stem cell- derived clonal progenitor cell line with chondrogenic potential and makers of craniofacial mesenchyme", REGEN MED., 23 April 2012 (2012-04-23)
- SAKAI ET AL., SPINE, vol. 30, 2005, pages 2379
- SAKAI ET AL., J. ORTHOP. RES., vol. 26, 2008, pages 589
- HUANG ET AL., SPINE J., vol. 13, 2013, pages 352
- STERNBERG ET AL., BIOMATTER, 2013, pages E24496
- KIM, M. ET AL.: "Age-related alterations in mesenchymal stem cells related to shift in differentiation from osteogenic to adipogenic potential: implication to age-associated bone diseases and defects", MECHANISMS OF AGEING AND DEVELOPMENT, vol. 133, 2012, pages 215 - 225, XP028505404, DOI: doi:10.1016/j.mad.2012.03.014
- CAPLAN, A.I.: "Mesenchymal stem cells", JOURNAL OF ORTHOPAEDIC RESEARCH : OFFICIAL PUBLICATION OF THE ORTHOPAEDIC RESEARCH SOCIETY, vol. 9, 1991, pages 641 - 650
- CAPLAN, A.I.: "Review: mesenchymal stem cells: cell-based reconstructive therapy in orthopedics", TISSUE ENGINEERING, vol. 11, 2005, pages 1198 - 1211
- PITTENGER, M.F. ET AL.: "Multilineage potential of adult human mesenchymal stem cells", SCIENCE, vol. 284, 1999, pages 143 - 147, XP002942313, DOI: doi:10.1126/science.284.5411.143
- NOMBELA-ARRIETA, C.; RITZ, J.; SILBERSTEIN, L.E.: "The elusive nature and function of mesenchymal stem cells", NATURE REVIEWS. MOLECULAR CELL BIOLOGY, vol. 12, 2011, pages 126 - 131, XP008167374, DOI: doi:10.1038/nrm3049
- BELTRAMI, A.P. ET AL.: "Multipotent cells can be generated in vitro from several adult human organs (heart, liver, and bone marrow)", BLOOD, vol. 110, 2007, pages 3438 - 3446, XP002536079, DOI: doi:10.1182/BLOOD-2006-11-055566
- BIANCO, P.; ROBEY, P.G.; SIMMONS, P.J.: "Mesenchymal stem cells: revisiting history, concepts, and assays", CELL STEM CELL, vol. 2, 2008, pages 313 - 319
- PELTTARI, K. ET AL.: "Premature induction of hypertrophy during in vitro chondrogenesis of human mesenchymal stem cells correlates with calcification and vascular invasion after ectopic transplantation in SCID mice", ARTHRITIS AND RHEUMATISM, vol. 54, 2006, pages 3254 - 3266
- GRANT, W.T.; WANG, G.J.; BALIAN, G.: "Type X collagen synthesis during endochondral ossification in fracture repair", J BIOL CHEM, vol. 262, 1987, pages 9844 - 9849
- GEBHARD, S. ET AL.: "BAC constructs in transgenic reporter mouse lines control efficient and specific LacZ expression in hypertrophic chondrocytes under the complete Col1(a1) promoter", HISTOCHEMISTRY AND CELL BIOLOGY, vol. 127, 2007, pages 183 - 194, XP019473904
- MAK, K.K.; KRONENBERG, H.M.; CHUANG, P.T.; MACKEM, S.; YANG, Y.: "Indian hedgehog signals independently of PTHrP to promote chondrocyte hypertrophy", DEVELOPMENT, vol. 135, 2008, pages 1947 - 1956
- TOPPING, R.E.; BOLANDER, M.E.; BALIAN, G.: "Type X collagen in fracture callus and the effects of experimental diabetes", CLINICAL ORTHOPAEDICS AND RELATED RESEARCH, 1994, pages 220 - 228
- MAO, J.J. ET AL.: "Craniofacial tissue engineering by stem cells", JOURNAL OF DENTAL RESEARCH, vol. 85, 2006, pages 966 - 979
- CREUZET, S.; COULY, G.; VINCENT, C.; LE DOUARIN, N.M.: "Negative effect of Hox gene expression on the development of the neural crest-derived facial skeleton", DEVELOPMENT, vol. 129, 2002, pages 4301 - 4313
- ISHII, M. ET AL.: "Combined deficiencies of Msx1 and Msx2 cause impaired patterning and survival of the cranial neural crest", DEVELOPMENT, vol. 132, 2005, pages 4937 - 4950
- LEVI, G. ET AL.: "Msx1 and Dlx5 act independently in development of craniofacial skeleton, but converge on the regulation of Bmp signaling in palate formation", MECHANISMS OF DEVELOPMENT, vol. 123, 2006, pages 3 - 16
- DEPEW, M.J.; LUFKIN, T.; RUBENSTEIN, J.L.: "Specification of jaw subdivisions by Dlx genes", SCIENCE, vol. 298, 2002, pages 381 - 385
- BONILLA-CLAUDIO, M. ET AL.: "Bmp signaling regulates a dose-dependent transcriptional program to control facial skeletal development", DEVELOPMENT, vol. 139, 2012, pages 709 - 719
- WEST, M.D. ET AL.: "The ACTCellerate initiative: large-scale combinatorial cloning of novel human embryonic stem cell derivatives", REGEN MED, vol. 3, 2008, pages 287 - 308, XP009175577, DOI: doi:10.2217/17460751.3.3.287
- STERNBERG, H. ET AL.: "A human embryonic stem cell-derived clonal progenitor cell line with chondrogenic potential and markers of craniofacial mesenchyme", REGEN MED, vol. 7, 2012, pages 481 - 501, XP009166713, DOI: doi:10.2217/rme.12.29
- BOXALL, S.A.; JONES, E.: "Markers for characterization of bone marrow multipotential stromal cells", STEM CELLS INTERNATIONAL, 2012
- ZHAO, Y. ET AL.: "Isolated cleft palate in mice with a targeted mutation of the LIM homeobox gene *lhx8*", PROC NATL ACAD SCI USA, vol. 96, 1999, pages 15002 - 15006
- ZHANG, Y. ET AL.: "Comparison of the expression patterns of two LIM-homeodomain genes, *Lhx6* and *L3/Lhx8*, in the developing palate", ORTHODONTICS & CRANIOFACIAL RESEARCH, vol. 5, 2002, pages 65 - 70
- GRIGORIOU, M.; TUCKER, A.S.; SHARPE, P.T.; PACHNIS, V.: "Expression and regulation of *Lhx6* and *Lhx7*, a novel subfamily of LIM homeodomain encoding genes, suggests a role in mammalian head development", DEVELOPMENT, vol. 125, 1998, pages 2063 - 2074
- TISSIER-SETA, J.P. ET AL.: "Barxl, a new mouse homeodomain transcription factor expressed in cranio-facial ectomesenchyme and the stomach", MECHANISMS OF DEVELOPMENT, vol. 51, 1995, pages 3 - 15
- TUCKER, A.S.; MATTHEWS, K.L.; SHARPE, P.T.: "Transformation of tooth type induced by inhibition of BMP signaling", SCIENCE, vol. 282, 1998, pages 1136 - 1138
- NIE, X.: "Developmentally regulated expression of *MSX1*, *MSX2* and *Fgfs* in the developing mouse cranial base", THE ANGLE ORTHODONTIST, vol. 76, 2006, pages 990 - 995
- SHAWLOT, W.; BEHRINGER, R.R.: "Requirement for *Lim1* in head-organizer function", NATURE, vol. 374, 1995, pages 425 - 430, XP002083776, DOI: doi:10.1038/374425a0
- YEUNG, G. ET AL.: "Cloning of a novel epidermal growth factor repeat containing gene *EGFL6*: expressed in tumor and fetal tissues", GENOMICS, vol. 62, 1999, pages 304 - 307, XP004444737, DOI: doi:10.1006/geno.1999.6011
- THOMAS, T. ET AL.: "A signaling cascade involving endothelin-1, dHAND and *msx1* I regulates development of neural-crest-derived branchial arch mesenchyme", DEVELOPMENT, vol. 125, 1998, pages 3005 - 3014
- DELAURIER, A.; SCHWEITZER, R.; LOGAN, M.: "Pitx1 determines the morphology of muscle, tendon, and bones of the hindlimb", DEVELOPMENTAL BIOLOGY, vol. 299, 2006, pages 22 - 34, XP024944595, DOI: doi:10.1016/j.ydbio.2006.06.055
- MINA, M.: "Regulation of mandibular growth and morphogenesis", CRITICAL REVIEWS IN ORAL BIOLOGY AND MEDICINE : AN OFFICIAL PUBLICATION OF THE AMERICAN ASSOCIATION OF ORAL BIOLOGISTS, vol. 12, 2001, pages 276 - 300
- KING, M.; ARNOLD, J.S.; SHANSKE, A.; MORROW, B.E.: "T-genes and limb bud development", AMERICAN JOURNAL OF MEDICAL GENETICS. PART A, vol. 140, 2006, pages 1407 - 1413
- AGULNIK, S.I.; PAPAIOANNOU, V.E.; SILVER, L.M.: "Cloning, mapping, and expression analysis of *TBX15*, a new member of the T-Box gene family", GENOMICS, vol. 51, 1998, pages 68 - 75, XP0044449403, DOI: doi:10.1006/geno.1998.5278
- GONG, S.G.; GONG, T.W.; SHUM, L.: "Identification of markers of the midface", JOURNAL OF DENTAL RESEARCH, vol. 84, 2005, pages 69 - 72

- JOHNSTONE, B.; HERING, T.M.; CAPLAN, A.I.; GOLDBERG, V.M.; YOO, J.U.: "In vitro chondrogenesis of bone marrow-derived mesenchymal progenitor cells", EXP CELL RES, vol. 238, 1998, pages 265 - 272
- LEONARD, C.M. ET AL.: "Role of transforming growth factor-beta in chondrogenic pattern formation in the embryonic limb: stimulation of mesenchymal condensation and fibronectin gene expression by exogenous TGF-beta and evidence for endogenous TGF-beta-like activity", DEVELOPMENTAL BIOLOGY, vol. 145, 1991, pages 99 - 109
- STECK, E. ET AL.: "Chondrocyte expressed protein-68 (CEP-68), a novel human marker gene for cultured chondrocytes", THE BIOCHEMICAL JOURNAL, vol. 353, 2001, pages 169 - 174, XP002906609, DOI: doi:10.1042/0264-6021:3530169
- WILSON, R. ET AL.: "Changes in the chondrocyte and extracellular matrix proteome during post-natal mouse cartilage development", MOLECULAR & CELLULAR PROTEOMICS : MCP 11, 2012, pages M111 014159
- AMANATULLAH, D.F.; YAMANE, S.; REDDI, A.H.: "Distinct patterns of gene expression in the superficial, middle and deep zones of bovine articular cartilage", JOURNAL OF TISSUE ENGINEERING AND REGENERATIVE MEDICINE, 2012
- CORMIER, S.; LEROY, C.; DELEZOIDE, A.L.; SILVE, C.: "Expression of fibroblast growth factors 18 and 23 during human embryonic and fetal development", GENE EXPR PATTERNS, vol. 5, 2005, pages 569 - 573
- SEITZ, S. ET AL.: "Preproenkephalin (Penk) is expressed in differentiated osteoblasts, and its deletion in Hyp mice partially rescues their bone mineralization defect", CALCIFIED TISSUE INTERNATIONAL, vol. 86, 2010, pages 282 - 293, XP019799215
- COUSSENS, A.K. ET AL.: "Unravelling the molecular control of calvarial suture fusion in children with craniosynostosis", BMC GENOMICS, vol. 8, 2007, pages 458, XP021032794
- ANDERSON, D.J.: "Molecular control of cell fate in the neural crest: the sympathoadrenal lineage", ANNUAL REVIEW OF NEUROSCIENCE, vol. 16, 1993, pages 129 - 158, XP008032051, DOI: doi:10.1146/annurev.ne.16.030193.001021
- NAGAI, T. ET AL.: "The expression of the mouse Zic1 Zic2, and Zic3 gene suggests an essential role for Zic genes in body pattern formation", DEVELOPMENTAL BIOLOGY, vol. 182, 1997, pages 299 - 313, XP002194263, DOI: doi:10.1006/dbio.1996.8449
- DUBOC, V.; LOGAN, M.P.: "Regulation of limb bud initiation and limb-type morphology", DEV DYN, vol. 240, 2011, pages 1017 - 1027
- LIU, W.; SELEVER, J.; LU, M.F.; MARTIN, J.F.: "Genetic dissection of Pitx2 in craniofacial development uncovers new functions in branchial arch morphogenesis, late aspects of tooth morphogenesis and cell migration", DEVELOPMENT, vol. 130, 2003, pages 6375 - 6385
- BALIC, A.; ADAMS, D.; MINA, M.: "Prx1 and Prx2 cooperatively regulate the morphogenesis of the medial region of the mandibular process", DEV DYN, vol. 238, 2009, pages 2599 - 2613
- FUKIISHI, Y.; MORRIS-KAY, G.M.: "Migration of cranial neural crest cells to the pharyngeal arches and heart in rat embryos", CELL AND TISSUE RESEARCH, vol. 268, 1992, pages 1 - 8
- IMAI, H.; OSUMI-YAMASHITA, N.; NINOMIYA, Y.; ETO, K.: "Contribution of early-emigrating midbrain crest cells to the dental mesenchyme of mandibular molar teeth in rat embryos", DEVELOPMENTAL BIOLOGY, vol. 176, 1996, pages 151 - 165
- NODEN, D.M.: "The role of the neural crest in patterning of avian cranial skeletal, connective, and muscle tissues", DEVELOPMENTAL BIOLOGY, vol. 96, 1983, pages 144 - 165, XP024850549, DOI: doi:10.1016/0012-1606(83)90318-4
- BAHNEY, C.S.; HSU, C.W.; YOO, J.U.; WEST, J.L.; JOHNSTONE, B.: "A bioresponsive hydrogel tuned to chondrogenesis of human mesenchymal stem cells", FASEB JOURNAL : OFFICIAL PUBLICATION OF THE FEDERATION OF AMERICAN SOCIETIES FOR EXPERIMENTAL BIOLOGY, vol. 25, 2011, pages 1486 - 1496
- BIAN, L.; ZHAI, D.Y.; ZHANG, E.C.; MAUCK, R.L.; BURDICK, J.A.: "Dynamic Compressive Loading Enhances Cartilage Matrix Synthesis and Distribution and Suppresses Hypertrophy in hMSC-Laden Hyaluronic Acid Hydrogels", TISSUE ENGINEERING. PART A, vol. 18, 2012, pages 715 - 724, XP055217013, DOI: doi:10.1089/ten.tea.2011.0455
- MAUCK, R.L.; YUAN, X.; TUAN, R.S.: "Chondrogenic differentiation and functional maturation of bovine mesenchymal stem cells in long-term agarose culture. Osteoarthritis and cartilage / OARS", OSTEOARTHRITIS RESEARCH SOCIETY, vol. 14, 2006, pages 179 - 189
- PARK, S.; HUNG, C.T.; ATESHIAN, G.A.: "Osteoarthritis and cartilage / OARS", vol. 12, 2004, OSTEOARTHRITIS RESEARCH SOCIETY, article "Mechanical response of bovine articular cartilage under dynamic unconfined compression loading at physiological stress levels", pages: 65 - 73

Citation (search report)

- [X] WO 2011009106 A2 20110120 - BIOTIME INC [US], et al
- [X] US 2009081784 A1 20090326 - VODYANYK MAKSYM A [US], et al
- [Y] WEST MICHAEL D ET AL: "The ACTCellerate initiative: large-scale combinatorial cloning of novel human embryonic stem cell derivatives", REGENERATIVE MEDICINE, vol. 3, no. 3, May 2008 (2008-05-01), pages 287 - 308, XP009175577, ISSN: 1746-0751
- [X] CHANG CHIH-HUNG ET AL: "Tissue Engineering-Based Cartilage Repair with Mesenchymal Stem Cells in a Porcine Model", JOURNAL OF ORTHOPAEDIC RESEARCH, vol. 29, no. 12, December 2011 (2011-12-01), pages 1874 - 1880, XP055096967
- [Y] GIUSEPPE MARIA DE PEPPO ET AL: "State of the Art in Stem Cell Research: Human Embryonic Stem Cells, Induced Pluripotent Stem Cells, and Transdifferentiation", JOURNAL OF BLOOD TRANSFUSION, vol. 86, no. 14, 1 January 2012 (2012-01-01), pages 5434 - 10, XP055096785, ISSN: 2090-9187, DOI: 10.1038/nature07042

Cited by

CN113166720A; US11685898B2; WO2020029567A1; WO2017151646A3

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